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From: ***Ross L. Franks*** Phone: 650-233-4897

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To:

Examiner A. Ly
Group 2172

Company: ***U.S. Patent & Trademark Office*** ***FAX NO.***
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Serial No. 09/757,435
Filed January 10, 2001
Kim et al.

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ATTACHMENTS:

1. ***Amendment and Response to Office Action with Request for Extension and authorization to charge deposit account for small entity extension fees***

If you have not properly received this fax, please call . Thank you.

Operator: Kathleen Smith 650-233-4575

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION of:
Kim et al.

Atty. Docket No. **053684-0300106**

Appln. No. **09/757,435**

Group Art Unit: **2172**

Filed: **January 10, 2001**

Examiner: **Anh Ly**

Title: **Systems And Methods Of Retrieving Relevant Information**

CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted **via facsimile** to **703-746-7239**, Group Art Unit **2172**, Commissioner for Patents, Alexandria, VA, on **October 10, 2003**.

By: Kathleen M. Smith
Kathleen M. Smith

AMENDMENT AND RESPONSE TO OFFICE ACTION

Mail Stop: **Non-Fee Amendment**
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

This is a response to the Office Action mailed April 10, 2003.

Petition for Extension of Time:

Applicants hereby petition for a 3-month extension of time, extending the period for response from July 10, 2003 to the date of this filing. The Commissioner is authorized to charge Deposit Account 03-3975, Order No. 053684-0300106, for the requisite 3-month small-entity extension fee of $475.00.

Please amend the application as follows:

IN THE CLAIMS:

1. (**Currently Amended**) A computer-implemented method of ranking the relevancy of a random collection of hypertext pages to a keyword-based query, comprising:

selecting randomly a page to rank from the random collection of hypertext pages;

calculating an intrinsic rank of ~~a page~~ the page;

calculating an extrinsic rank of the page; and

calculating the rank of the page by combining the intrinsic rank and the extrinsic rank.

2. (Original) The method of claim 1, wherein the intrinsic rank is a function of the content score and the page weight of the page.

3. (**Currently Amended**) The method of claim 2, wherein the content score is a function of ~~the~~ at least one of a frequency, a location, ~~and/or~~ and a font size of a keyword in the page.

4. (**Currently Amended**) The method of claim 2, wherein the page weight is defined as ~~the~~ a probability ~~of~~ that a user visiting the page when traveling in the random collection of hypertext pages in a random fashion.

5. (Original) The method of claim 2, wherein the page weight is obtained as the sum of the product of a link weight of each inbound link to the page and the page weight of the originating page.

6. (**Currently Amended**) The method of claim 2, wherein the page weight is computed by the following steps of:

constructing a connectivity graph, which represents the random collection of hypertext pages and the link structure between the pages;

adding a page weight reservoir with bi-directional links to and from each of the pages in the random collection of hypertext pages; and

summing all of the products of each inbound link weight with the page weight of the originating page providing the inbound link.

7. (**Currently Amended**) The method of claim 2, further comprising computing the page weights by the following steps of:

initializing a page weight vector to a constant;

constructing a connectivity graph representative of the link structure of the random collection of pages;

computing an output page weight vector from the input page weight vector and the connectivity graph; and

comparing the output page weight vector with the input page weight vector for convergence, and if convergence is reached, writing the output page weight vector in a page weight database, and if not, mixing the input and output page weight vectors to generate a new input page weight vector and repeating until convergence is reached.

8. (**Currently Amended**) The method of claim 5, wherein the link weight is defined as the probability of a user randomly choosing the link to visit other pages when traveling in the random collection of hypertext pages.

9. (Original) The method of claim 5, wherein the link weight of the inbound links has a uniform value corresponding to the reciprocal of the total number of links outbound from an originating page.

10. (**Currently Amended**) The method of claim 5, wherein the link weight has a variable value, which depends on at least one of the number of outbound links, the offset of the link, the size of the paragraph where the link is located, ~~and/or~~ and whether the link is an external or internal link.

11. (Original) The method of claim 1, wherein the extrinsic rank is a function of the anchor weight and the page weight of the pages providing inbound links to the page.

12. (Original) The method of claim 1, wherein the extrinsic rank is obtained by summing the products of the anchor weight and the page weight of the originating page providing each inbound link.

13. (Original) The method of claim 11, wherein the anchor weight is a function of the inbound link weights and the keyword being present in the anchor text, in the vicinity of the anchor text, or in text related to the topic of the anchor text.

14. (**Currently Amended**) The method of claim 11, wherein the page weight is defined as the probability of a user randomly visiting a page in the random collection of hypertext pages.

15. (Original) The method of claim 11, wherein the page weight is obtained by summing the products of the link weight of each inbound link to the page and the page weight of the originating page providing the inbound links.

16. (**Currently Amended**) The method of claim 11, wherein the page weight is computed by the following steps of:

constructing a connectivity graph, which represents the random collection of hypertext pages and the link structure between the pages;

adding a page weight reservoir with bi-directional links to and from each of the pages in the random collection of hypertext pages; and

summing all of the products of each inbound link weight with the page weight of the originating page providing the inbound link.

17. (**Currently Amended**) The method of claim 11, further comprising computing the page weights by the following steps of:

initializing a page weight vector to a constant;

constructing a connectivity graph representative of the link structure of the random collection of pages;

computing an output page weight vector from the input page weight vector and the connectivity graph; and

comparing the output page weight vector with the input page weight vector for convergence, and if convergence is reached, writing the output page weight vector in a page weight database, and if not, mixing the input and output page weight vectors

to generate a new input page weight vector and repeating until convergence is reached.

18. (**Currently Amended**) The method of claim 15, wherein the link weight is defined as the probability of a user randomly choosing the link to visit other pages when traveling in the random collection of hypertext pages.

19. (Original) The method of claim 15, wherein the link weight of the inbound links has a uniform value corresponding to the reciprocal of the total number of links outbound from an originating page.

20. (**Currently Amended**) The method of claim 15, wherein the link weight has a variable value, which depends on at least one of the number of outbound links, the offset of the link, the size of the paragraph where the link is located, ~~and/or~~ and whether the link is an external or internal link.

21. (**Currently Amended**) The method of claim 1, wherein the random collection of hypertext pages is fetched from the Web.

22. (**Currently Amended**) A computer-implemented method of ranking a random collection of hypertext pages, comprising:

selecting randomly a page to rank from the random collection of hypertext pages;

calculating the intrinsic rank of ~~a page~~ the page for a multi-keyword query;

calculating the extrinsic rank of the page for the multi-keyword query; and

calculating the rank of the page in the random collection of hypertext pages by combining the intrinsic rank and the extrinsic rank.

23. (Original) The method of claim 22, wherein the intrinsic rank is a function of content score and the page weight.

24. (**Currently Amended**) The method of claim 23, wherein the content score is a function of the proximity value of the multi-keywords and of at least one of the frequency, location, ~~and/or~~ and font size of the multi-keywords in the page.

25. (Original) The method of claim 22, wherein the extrinsic rank of the page is a function of the partial extrinsic ranks and the proximity value of the multi-keywords.

26. (Original) The method of claim 25, wherein partial extrinsic rank is a function of the anchor weight and the page weight of the pages with identical anchor text.

27. (Original) The method of claim 25, wherein partial extrinsic rank is computed by summing the products of the anchor weight and the page weight of the pages with identical anchor text.

28-52. (Cancelled).

REMARKS

Applicants respectfully request reconsideration and allowance in view of the foregoing amendments and following remarks. In the Office Action, mailed April 10, 2003, the Examiner rejected claims 1-27. By this amendment, claims 1, 3, 4, 6-8, 10, 14, 16-18, 20-22 and 24 have been amended to further clarify the invention. Following entry of these amendments, claims 1-27 will be pending in the application.

Claim Rejections under 35 U.S.C. §103(a)

In the Office Action, the Examiner rejected claims 1-27 under 35 U.S.C. §103(a) as allegedly being obvious over the cited references. Specifically, the Examiner rejected claim 1-3, 5-7, 11-13, 15-17 and 21-27 as allegedly being unpatentable over U.S. Patent No. 6,112,203 to Bharat et al. (hereinafter, "Bharat"). Further, the Examiner rejected claims 4, 8-10, 14 and 18-20 as allegedly being unpatentable over Bharat in view of U.S. Patent No. 5,835,905 to Pirolli et al. (hereinafter, "Pirolli"). Applicants respectfully traverse the rejections of claims 1-27, and note for subsequent reference the following standards for a proper §103(a) rejection.

A §103(a), or obviousness, rejection is proper only when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains." 35 U.S.C. §103(a). The Examiner must make out a *prima facie* case for obviousness. The mere fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness. The *en banc* Federal Circuit has held that "structural similarity between claimed and prior art subject matter, proved by combining references or otherwise, where the prior art gives reason or motivation to make the claimed compositions, creates a *prima facie* case of obviousness." *In re Dillon*, 16 U.S.P.Q. 2d 1897, 1901 (CAFC 1990). The underlying inquiries into the validity of an obviousness rejection are: "(1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness." *In re Dembiczak*, 175 F.3d 994, 998, (Fed. Cir. 1999).

General Technical Distinctions

In the Office Action, the Examiner continually compared the "intrinsic rank" and "extrinsic rank" of Applicants' invention to the hub authority analysis of the cited art. Before discussing the specific distinctions between at least some of Applicants' claims and the cited art, Applicants provide the Examiner with the following general technical distinctions of Applicants' invention.

One obvious difference between Applicants' invention and the cited art is that Applicantsclaims how a search engine ranks the whole web collection and selects the most "important" pages. The Examiner's cited art describes applications to re-process search engine results, and from there, to re-rank the web pages. This fundamental difference means that Applicants' rank algorithm does not assume any predefined nature or property in the web page set to be processed, where cited art refines the ranking of a subset of web pages that represent some topic or concept already searched. Therefore, the "relevance weights" used in the cited art are topic sensitive; but Applicants' "page weights" are topic independent.

Another basic, but critical, difference between Applicants' claimed invention and the Examiner's cited art is that Applicants' "intrinsic rank" and/or "extrinsic rank" are not the same as the cited art's "authority score" and/or "hub score". It is important for the understanding of Applicants' claimed invention to appreciate the differences between these concepts.

The hub authority analysis of the cited art is different than Applicants' form of link analysis. The hub authority analysis is a kind of "mutual reinforcement" between hub pages and authority pages. But, Applicants' page weight calculation is a "self reinforcement" for the web pages themselves. The logic underlying the cited art's hub authority analysis is that the good authority pages are the ones that are pointed to by the good hub pages, and that the good hub pages are the ones that are pointing to the good authority pages. But, the logic underlying Applicants' page weight calculation is that the important pages are the pages pointed to by other important pages. In the cited art's hub authority analysis, each page is assigned two scores: the hub score; and the authority score. But in Applicants' page weight analysis, only one page weight is assigned to each web page.

Further, the hub authority analysis of the cited art is only using the hyperlink relationship between the hub and authority pages. This is a pure link analysis (i.e., only analyses links). It does not use any content or text (e.g., semantic or syntactic) information from web pages. But in Applicants' claimed invention, both the "intrinsic rank" and the "extrinsic rank" use text information as well as the link information.

The Examiner's cited art uses scoring functions that are similar to the traditional Importance Ranking (IR); that is, they use feature vector space to represent a topic of query or a web page. But, Applicants' ranking algorithm does not use this traditional IR approach. Applicants' ranking method is different from the traditional IR vector space approach and cosin scoring because Applicants' "extrinsic rank" is the ranking score generated from all extrinsic sources, text and hyperlinks. It is a kind of "citation," or opinion from outside of the page being scored. The contribution of these "outside" opinions is weighted by the page weight (or importance) of the source pages. This ranking method is unique to Applicants, and has not been suggested or disclosed by any of the Examiner's cited art.

Independent Claims 1 and 22

Amended independent claims 1 and 22 set forth a method of ranking hypertext pages including, *inter alia*, randomly selecting a page from a random collection of hypertext pages and ranking that page by combining an intrinsic rank for the page to an extrinsic rank for the page. For the reasons stated below and taking into consideration the standards for obviousness and general discussion presented above, Applicants assert that one of ordinary skill in the art would not have considered Applicants' invention obvious at the time of invention and, therefore, that Applicants' rejected independent claims 1 and 22 are not obvious over the prior art of record.

In rejecting claims 1 and 22, the Examiner uses Bharat to compare to Applicants' concepts of "intrinsic" and "extrinsic" ranks. Applicants' respectfully submit that the Examiner has misunderstood the concepts of "intrinsic" and "extrinsic" rank. The Examiner pointed out in several places that the authority pages and hub pages (Bharat, col. 2 ll. 6-10; and col. 7, ll. 41-51) are equivalent to Applicants' "intrinsic" and "extrinsic" rank information; and thus concluded that Applicants' independent claims were unpatentable over Bharat. Applicants' assert that this

equivalence comparison is incorrect. First, for background purposes, the hub-authority algorithm was first presented in the earlier work of Kleinberg. Second, the hub-authority algorithm of Bharat is discussing pure link analysis and does not use any text or web content information at all. By contrast, Applicants' "intrinsic rank" and "extrinsic rank" are constructed using both web text content and the resulting link analysis, i.e. from the page weight. Third, Applicants' "extrinsic rank" specifically requires the use of anchor text (or citation), or any other text description (e.g., neighborhood text of anchor text, etc.) from "extrinsic" sources. But, Bharat, as well as Kleinberg's paper does not use these other data.

Similarly, at col. 7, ll. 44-46 and at col. 8, ll. 10-14, Bharat discusses separate hub score and authority score, and how to use them to rank web pages. The Examiner mistakenly equates these to Applicants' "extrinsic" and "intrinsic" scores. While Applicants' claimed invention does partially use a form of link analysis (along with page weight), it does not distinguish a hub page weight (i.e., the equivalent to a Bharat hub score) or a authority page weights (i.e., the equivalent to a Bharat authority score).

Therefore, for at least these reasons, Applicants respectfully submit that amended independent claims 1 and 22 are in a condition for allowance, and respectfully request a Notice to that effect.

Dependent Claims 2, 3, 5-7, 11-13, 15-17, 21 and 23-27

Dependent claims 2, 3, 5-7, 11-13, 15-17, 21 and 23-27 ultimately depend from amended independent claims 1 and 22. The allowability of dependent claims 2, 3, 5-7, 11-13, 15-17, 21 and 23-27 thus follows from the allowability of amended independent claims 1 and 22, respectively; as such, dependent claims 2, 3, 5-7, 11-13, 15-17, 21 and 23-27 are allowable over the art of record.

Further, as to the specific allegations of the Examiner regarding dependent claims 2, 3, 5-7, 11-13, 15-17, 21 and 23-27, Applicants assert the following counter-arguments.

A careful reading of Bharat, at col. 7, ll. 41-45, and col. 9, ll. 1-16, reveals that this paragraph is just merely discussing Kleinberg's hub-authority process on a subset (i.e., on one topic) of web pages that have minor differences in their link weight settings (instead of 1, it uses

1/k and k to represent the number of outbound links from the source page). Bharat does not disclose or suggest anything about how to combine the content score with a page weight as does Applicants' claimed invention.

Also, Bharat, at col. 7, ll. 28-38, merely discloses the conventional IR measure by calculating cosin between two "feature vectors," one representing the query topic and one for a web page. Each feature vector is constructed using word frequency and inverse document frequency. In terms of an IR measure, the Bharat approach is totally different from the content score Applicants' invention. The first difference is that Applicants' "content score" is not calculated using cosin function. Second, the important part of "content score" is the proximity for queries containing multiple words. The proximity, in this circumstance, needs to be calculated using word position in the body text, title, or other text of the web pages, but the "vector space" approach of Bharat does not (and could not) use the position (or location) information.

Further, in Bharat col. 2, ll. 6-16, a prior art technique of Kleinberg is discussed. Similarly, Bharat mentions in col. 1, ll. 51-59, "In one prior art technique, an algorithm for connectivity analysis of a neighborhood graph (n-graph) is described by Kleinberg in "Authoritative Sources in a Hyperlinked Environment." And, in col. 2, ll. 6-16, Bharat admits it is the continuation of this description of this prior art. Kleinberg's hub-authority algorithm is different from the algorithm described in Applicants' claimed invention. Kleinberg explicitly distinguishes the "hub" pages and "authority" pages, and assigns different weights to them for each page, namely, "hub weight" and "authority weight." But, Applicants' claimed invention only defines one "page weight" for each page, which is different from either the "hub weight" or the "authority weight". Bharat defines the way of calculating the "hub weight" and "authority weight" as "a mutually reinforcement relationship" (see Bharat, col. 2, ll. 8–9). By contrast, the way of calculating Applicants' "page weight" is not "mutually reinforcement", it is a "self-reinforcement", namely the page weight is calculated using the page weight of inbound links (along with text and content information).

Regarding to col. 5, ll. 21–30 of Bharat , this discussion is about how to assign the "relevance weight" to the node within the subset of the Bharat link graph. First, this "relevance

weight" is a totally different concept from the "page weight" of Applicants' claimed invention. As Bharat states, "The relevance weight measures the similarity between the represented page and the query topic." It is to measure how relevant a given page is to the specified topic. But, the "page weight" of Applicants' invention is topic independent. "Page weight" has nothing to do with topics at all. Rather, "page weight" is the probability of a user visiting the page. Second, the way to assign the Bharat "relevance weight" is totally different from the way of assigning Applicants' "page weight." As pointed out in col. 5, ll. 27–30 of Bharat, "we use a subset of the pages of the start set 201 to define a broader query topic "Q", and match the pages "P" represented in the graph with the broader topic to determine the relevance weight of the nodes 212". From a continued reading of the paragraphs following this quote, Bharat asserts that both the broader topic "Q" and the represented page "P" are represented using the "vector space" approach, calculating the cosin between the two "vectors", and Bharat calls this the "relevance weight." This is apparently different from Applicants' invention; namely, "the page weight is obtained as the sum of the product of a link weight of each inbound link to the page and the page weight of the originating page."

As for col. 6, ll. 17–49 of Bharat, the reference discloses "Pruning the Graph," namely, how to remove some nodes from the formed link graph. Basically, it has no relation with how to do connectivity analysis or calculate the page weight as described in Applicants' invention. Two approaches are described by Bharat. One is "Threshold Based Pruning," which means to remove some nodes according the threshold of "relevance weight." Applicants' have already pointed out, above, that the "relevance weights" are different from Applicants "page weights." The second approach of Bharat to "prune the graph" is so called "Degree Based Pruning," which is a kind of two step threshold pruning. The first step is to calculate the "degree" for each page using "in_degree" and "out_degree," which are simply calculated using the number of inbound and outbound links. Then, the second step uses the degrees to select a subset of nodes using the threshold pruning, then uses the relevance weight to do the threshold pruning. The whole process has no relevance to Applicants' page weight calculation steps.

Therefore, for at least these reasons, Applicants respectfully submit that dependent claims 2, 3, 5-7, 11-13, 15-17, 21 and 23-27 are in a condition for allowance, and respectfully request a Notice to that effect.

Dependent Claims 4, 8-10, 14 and 18-20

Dependent claims 4, 8-10, 14 and 18-20 ultimately depend from amended independent claim 1. The allowability of dependent claims 4, 8-10, 14 and 18-20 thus follows from the allowability of independent claim 1, respectively; as such, dependent claims 4, 8-10, 14 and 18-20 are allowable over the art of record.

Further, as previously discussed in relation to Applicants' invention, the methods and possible applications of the methods of Applicants' rejected claims are totally different than in the cited art. The major differences can be summarized as follows:

1) They process different sets of documents or web pages.

The cited art handles a particular set or subset of web pages from a set of web pages generated in some way (e.g., by search engine, for example). But Applicants' invention defines the page weight "as the probability of a user visiting the page." This definition can be applied to the entire Web, which is generally an open set.

2) The measures are different.

The cited art only discusses "relevance weight" assigned to each node, which is a relevance measure to a given topic or query, measuring how relevant a given page is to a given topic or a query. But, the page weight of Applicants' invention, generally, is the "popularity," "importance," or "visiting probability" of a web page. Applicants' page weight is topic, or query, independent.

3) The processes are different.

The cited art describes the detailed method and process on how to select a subset from the first set "based on the similarity of the document represented by the node to the topic," and then "selecting a second subset," and then "pruning a particular node from the second subset,"and so

on. This is a totally different process from Applicants' claimed invention, which is just a page weight definition and does not involve any "subset" selection process.

Therefore, for at least these reasons, Applicants respectfully submit that dependent claims 4, 8-10, 14 and 18-20 are in a condition for allowance, and respectfully request a Notice to that effect.

Conclusion

In view of the foregoing and because all objections and rejections have been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

CHARGE STATEMENT: The Commissioner is hereby authorized to charge fees that may be required relative to this application, or credit any overpayment, to our Account 03-3975, Order No. 053684-0300106 (LS-003).

Respectfully submitted,
PILLSBURY WINTHROP LLP

By: _____
Ross L. Franks, Reg. No. 47,233
For: David A. Jakopin, Reg. No. 32,995

2550 Hanover Street
Palo Alto, CA 94304-1115
Tel. No.: (650) 233-4897
Fax No.: (650) 233-4545

60315523